Aerospace Power

The development of systems with the ability to leave the earth's surface and operate in militarily useful ways has opened a third dimension to warfare. That third—vertical—dimension is the aerospace environment. The ability to operate in that environment is the source of aerospace power. This essay defines aerospace power, discusses the components of the definition, and describes the effect aerospace power has had on the conduct of warfare.

Aerospace Power Defined

Maj Gen William "Billy" Mitchell, writing before space became a consideration, described the concept of airpower this way: "Air power may be defined as the ability to do something in the air. It consists of transporting all sorts of things by aircraft from one place to another."[1] The benefit of 65 more years of aerospace history leads us to modify General Mitchell's all-inclusive airpower definition to fit military use in the aerospace era: Aerospace power results from the ability to use a platform operating in or passing through the aerospace environment for military purposes.[2] These military purposes ultimately affect surface military activities. Similarly, surface military operations can influence aerospace power. This relationship explains why joint operations are critically important.

From our definition, it is clear that aerospace power is not the sole domain of the Air Force. Currently, all United States military services, as well as those of many other nations, operate aerospace systems of one kind or another. For that reason, we believe that the doctrine in this manual should apply to all aerospace systems without regard to the uniforms worn by those who operate them.

Examination of our aerospace power definition reveals that there are two critical ingredients in producing aerospace power. The first ingredient concerns platforms operating in the aerospace environment, and the second concerns use or exploitation of the environment for military purposes.

Aerospace Platforms

Platforms used to exercise aerospace power include fixed- and rotary-wing aircraft, ballistic and cruise missiles, and satellites. Aerospace platforms can be distinguished by a variety of operating characteristics such as methods to achieve and maintain flight; differences in speed, altitude, endurance, range, payload, and maneuverability; whether manned or unmanned; and variations in reliability, maintainability, and cost. Each of these characteristics has important military implications, and—due to technical constraints—the characteristics tend to compete with each other. Thus, a design that enables an aircraft to carry a large, heavy payload is likely to limit its maneuverability and speed, as well as make it easier for an enemy to detect and destroy the aircraft.

In designing an aerospace platform, one must first ask what purpose the platform will serve—what mission(s) it will perform. Designers must make several assumptions in determining this purpose, such as what the employment situation will be, where the platform will operate, and what capabilities potential enemies are likely to possess. Once the designers make these assumptions and define the purpose, they must accommodate a variety of design considerations. Some of the most important considerations include the following: What will the payload be—both kind and amount? What kind of platform will fulfill the stated purpose most effectively under the assumed conditions? Should it be manned or unmanned? Should it be reusable? How fast must it go? How far must it go with what payload? What kind of base should it be able to operate from or to? What kind of threat will it face? How expensive should it be to produce and operate? What kind of weather must it be capable of operating in?

Depending on the platform's purpose, some of these design considerations will take precedence over others, and trade-offs will have to be made. As a result of these decisions, a platform design emerges with specific characteristics such as size, weight, speed, range, maneuverability, complexity, and cost. These factors, in turn, influence the reliability, maintainability, and mission availability of the platform as well as the number of platforms that will be bought.

Invariably, not all the assumptions made at the beginning of this process remain valid, especially if the platform remains in service for many years. In other words, the capabilities and limitations of the platform ultimately depend on the employment situation it actually encounters—not on design assumptions.

Exploiting the Aerospace Environment

A glance at the early history of manned flight reveals how platforms have exploited the aerospace environment to achieve military objectives. The first example of military exploitation of the environment—beginning as early as 1794 during the French revolutionary wars—was the use of balloons to observe land force movements and to spot for artillery fire.[3] The first airplanes were used in similar roles. These missions exploited the aerospace environment by transporting observers through the air to obtain militarily important information and thereby to increase the effectiveness of land forces.[4]

Predictably, the next mission given to airplanes was to prevent enemy observation aircraft from accomplishing their mission. Initially, pilots attempted to shoot down observation aircraft with hand-held weapons and then with machine guns mounted to their aircraft.[5] Such missions used the aerospace environment to transport weapons to accomplish a military objective—to prevent the enemy from obtaining militarily significant information. The competing attempts to obtain information and to prevent the enemy from obtaining information led to "dogfights" and the birth of the aerospace control mission.

Early space system employment seems to be following a similar course. The mission of many military satellites is to "observe," both optically and electronically, enemy activities as well as meteorological and other conditions in areas of possible dispute. Communication and navigation are two other militarily significant missions filled by a growing number of satellites. Predictably, great interest is developing in finding ways to prevent satellites from accomplishing their missions.[6] The important point is that these

observation, communication, and navigation platforms are actually using the aerospace environment to achieve military objectives and are producing or are prepared to produce aerospace power. When antisatellite weapons are developed, they will likewise use the aerospace environment to achieve the military purpose of preventing other platforms from accomplishing their missions.

Effect of Aerospace Power

The most pronounced change to warfare initiated by aerospace power involves geography and the time-distance relationship. In the past, war was a relatively slow-moving activity that could become bogged down in such stalemates as the trench warfare of World War I. War was constrained by geography, which usually restricted it to relatively small portions of the earth's surface at any one time. With the advent of aerospace power, the geographic limitations have been circumvented, and war that can simultaneously affect the entire width and breadth of the earth is a possibility.

Aerospace power also has given an immediacy to war that did not previously exist. Formerly, a nation usually could refrain from seriously preparing for war until there were indications that an enemy was mobilizing for war. Deployment speeds often allowed a defender sufficient time to gather supplies and assemble troops before the enemy could reach the battleground. In the aerospace age, the time required to cover even global distances is expressed in minutes and seconds rather than weeks and months. While physical distances between points on the earth have not changed, the increased speeds of aerospace platforms and their ability to surmount terrain obstacles (including coastlines) have modified the time-distance relationship to the point that isolationism is not much more than a fond memory, and nations feel compelled to remain constantly prepared for war.[7]

War has always involved creating advantages for oneself and dilemmas for one's enemy. Aerospace power has not changed that but has multiplied the options available to a commander. Since all points on the surface of the earth are now vulnerable, a commander

with sufficient quantities and types of aerospace platforms has the ability to strike all facets of an enemy's power structure. Thus, aerospace power increases the opportunities to create predicaments for the enemy and favorable circumstances for friendly forces. For example, because the Allies had control of the air during the World War II battle for Normandy, German forces were faced with the prospect of moving their land forces forward during daylight, at great risk from the unrelenting pressure of Allied air interdiction, or moving them only under the cover of night, but at a speed too slow to thwart the Allied invasion.[8] Along with the positive aspects of aerospace power, commanders must also recognize the potential dilemmas that enemy aerospace forces can produce and must be on guard against such traps. For these reasons, obtaining control of the aerospace environment is a priority in modern warfare.

Another, and perhaps the most dramatic, effect that aerospace power has had on war is in deterrence. Many people credit the dilemmas created by aerospace platforms capable of delivering nuclear weapons worldwide with deterring direct superpower conflict since the end of World War II.[9] At the same time, this combination has not deterred limited wars. The potentially catastrophic effects of nuclear weapons may even have given some lesser powers license for aggression because they saw that the superpowers were deadlocked and would not risk annihilation over relatively minor problems.[10] However, the end of the cold war and the advent of greater cooperation among the nuclear superpowers could change this perception in the future.

Another effect of aerospace power is the requirement it imposes on land, sea, and aerospace forces to coordinate their efforts. As Douhet pointed out,

> The use of military, naval, and aerial forces in war should be directed toward a single end, to win. To attain maximum effectiveness these forces must be co-ordinated and in harmony with one another. The three forces should function as ingredients—or factors—of a single product in which the best results can be obtained only by a proper apportioning of the ingredients used.[11]

World War II leaders echoed the necessity of orchestrating land, sea, and air efforts. For example, Gen Dwight D. Eisenhower in testimony to the Senate Committee on Military Affairs said, "One of the most important and least understood factors in modern war is that it is essentially a matter of perfected teamwork . . . there is no such thing as a separate land, sea, or air war."[12] In recognition of this truth, Congress has mandated closer harmony among the US services.[13]

Perhaps the most significant change that aerospace power has helped to produce, especially in combination with nuclear weapons, is an imperative for full integration of military and political thinking about war. For centuries, such great thinkers as Clausewitz have recognized "*that war is nothing but the conntinuation of policy with other means* [emphasis in original]."[14] Still, the decision to go to war remained primarily the politicians', and decisions about how to fight were largely the generals'. Now, in the aerospace/nuclear age, because of the increased rapidity with which war can occur and the extreme consequences war can produce, "the decisions whether we fight and how we fight must be combined military-political decisions, and combined in the fullest possible sense of the term."[15]

Conclusion

Our aerospace power definition has two parts: the fact that platforms of various types operate in the third dimension and the fact that those platforms actually exploit the aerospace environment to accomplish military objectives. The definition provides a general framework for reference and a basis for understanding and communication.

Aerospace power has affected warfare by altering the time-distance relationship to make war a much more nearly instantaneous undertaking. It has given commanders additional ways to produce dilemmas for the enemy, but it has also brought with it a corresponding requirement to protect oneself against predicaments the enemy can produce. In addition, the ability to operate in the aerospace environment has created a requirement for increased unity

not only among land, sea, and aerospace forces but also between the military and political aspects of warfare.

Notes

1. Maj Gen William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military* (1925; reprint, Port Washington, N.Y.: Kennikat Press, 1971), xii.

2. The aerospace power definition in the text is the same as that found in volume I of AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force*, March 1992 . There are many definitions of airpower. For example, Lord Arthur William Tedder defined it this way: "Air power is the ability to use the air spaces for offensive, defensive, and supply services, and to deny their use to the enemy." Air Chief Marshal of the Royal Air Force Lord Tedder, *Air Power in War* (London: Hodder and Stoughton, 1948), 30.

3. Basil Collier, *A History of Air Power* (New York: Macmillan Publishing Co., Inc., 1974), 8.

4. The first radio transmission from a ground station to an airplane occurred during the war between Italy and Turkey that began in 1911. That war also produced the first reconnaissance over enemy lines from an airplane on 23 October 1911, the first bombing mission from an airplane on 1 November 1911, and the first night bombing raid on 8 May 1912. By 1914 experiments had begun to develop radio communications from spotter aircraft to artillery. Lee Kennett, *A History of Strategic Bombing* (New York: Charles Scribner's Sons, 1982), 13. For additional insight into the early military uses of aircraft, see Robert Frank Futrell, *Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force, 1907–1964* (Maxwell AFB, Ala.: Air University, 1971), 8–10; and Thomas E. Mackin, *US Air Power: Ascension to Prominence* (Maxwell AFB, Ala.: Air University, 1974), 33–46.

5. David MacIsaac, "Voices from the Central Blue," in *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, N.J.: Princeton University Press, 1986), 628.

6. Air Commodore P. D. L. Gover, "Air Superiority—The Enduring Principle," in *War in the Third Dimension; Essays in Contemporary Air Power*, ed. Air Vice-Marshal R. A. Mason (London: Brassey's Defence Publishers, 1986), 80. Here Gover notes:

> Recent developments in the space environment have produced echoes of the early days of aviation which merit comment. The first of the parallels is unexceptional, in that much of the activity in the early years of both aviation and space was associated with developing knowledge of the new environment. The second parallel, however, is more

> intriguing: the use of the new medium for the reconnaissance task and the broad gathering of intelligence. To date, space and satellite systems have been invulnerable to enemy counter-action. But in line with the maxim that "if a reconnaissance mission is worth mounting, it is in the enemy's interest to prevent that mission succeeding," it is not surprising that development is currently taking place into anti-satellite weapons systems. Current technology limits consideration to target systems in low earth orbits or trajectories, but is unlikely to remain so.

7. Eugene M. Emme, ed., *The Impact of Air Power: National Security and World Politics* (Princeton, N.J.: D. Van Nostrand Co., Inc., 1959), 99–105.

8. Wesley F. Craven and James L. Cate, eds., *The Army Air Forces in World War* II, vol. 3, *Europe: ARGUMENT to V-E Day, January 1944 to May 1945* (Chicago: University of Chicago Press, 1951; new imprint, Washington, D.C.: Office of Air Force History, 1983), 218. This valuable history provides the following description of the German transportation dilemma:

> Travel by night was the only safe procedure, and at that season of the year daylight prevailed for sixteen hours in each twenty-four. Moreover, night travel forced the wide spacing of convoys on the roads and the use of low speed, at the very time when the ever increasing distance of railheads from the front increased the mileage which trucks must negotiate.

For a complete description of aerospace power's part in the invasion and the results, see pages 185–227.

9. Emme, 103.

10. Bernard Brodie, "Changing Strategic Outlooks," in *The Impact of Air Power*, 832.

11. Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari (New York: Coward-McCann, Inc., 1942), 70.

12. Senate Committee on Military Affairs, *Department of Armed Forces, Department of Military Security: Hearings before the Committee on Military Affairs*, 79th Cong., 1st sess., 1945, 363. General Eisenhower made his statement on 16 November 1945 as part of his testimony before the committee during its deliberations over S. 84, *A Bill to Provide for a Department of Armed Forces, Secretary of the Armed Forces, Under Secretaries of Army, Navy, and Air, and for Other Purposes;* and S. 1482, *A Bill to Establish a Department of Military Security, to Consolidate Therein the Military Security Activities of the United States, and for Other Purposes.*

13. To strengthen "joint military preparation, planning and operations" between the three military departments and four services, the Department of Defense Reorganization Act of 1986 (Goldwater-Nichols Act) was proposed and

passed by Congress. The Senate Committee on Armed Services report included the following rationale for changing command relationships within unified and specified commands: "Currently, the combatant commanders do not have authority over joint training or over any aspect of support and administration. The Committee believes that the expanded command authority is required for combatant commanders to carry out effectively their assigned missions." Senate Committee on Armed Services, *Department of Defense Reorganization Act of 1986: Report to Accompany S. 2295*, 99th Cong., 2d sess., 14 April 1986, 40–41.

14. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1984), 69.

15. Brodie, 839.